to lunch, and to illuminations and fireworks in the Curhaus Gardens in the evening. A large party also went to Marburg on the same day. There was an abundance of literature specially prepared for visitors, and in addition to separate guides to Frankfort for the use of gentlemen and for ladies, Dr. Ziegler and Prof. König had published a large post quarto volume on "Das Klima von Frankfurt am Main" in which they discussed all available meteorological information, the letterpress occupying eighty-four pages, the tables fifty-one pages, and ten double-page diagrams. The records of ice on the river are complete from the year 1825, but prior to that date they are irregular, extending, however, as far back as January 1306.

Several rooms had been set apart for the exhibition of entomological collections; of Jenner relics (the centenary of inoculation for the small-pox); of Röntgen-ray photographs—of the manner in which the photographs are produced; and many other subjects of a scientific or medical character.

A large number of foreigners came to Frankfort to attend the meetings, those from England being Sir William MacCormac, Prof. Armstrong, Mr. Harries, and Drs. Semon and Thin.

NOTES.

THE Gatty Marine Laboratory, which is a continuation of the oldest Marine Laboratory in Britain, will be opened by Lord Reay on Friday, October 30. Invitations to the opening ceremony have just been sent out by the University of St. Andrews.

CABLEGRAMS from Australia report the death, at Melbourne, on October 9, at the age of seventy-one, of Baron Sir Ferdinand von Müller, the eminent botanist, who has added so much to our knowledge of the flora of our Australian Colonies. A German by birth, Baron von Müller had resided in Australia just half a century. He was a Fellow of the Royal Society, and Botanist to the Colonial Government.

THE death is announced of Dr. M. W. Drobisch, Professor of Philosophy in the University of Leipzig, and distinguished for his mathematical as well as his philosophical researches.

THERE seems to be no room for doubt that the company which has acquired the world-renowned Giant's Causeway, intends to prevent free access to it. The honorary secretary of the Ballymoney Sub-committee of the Defence Committee formed to assert public rights, having, in company with other members of the Sub-committee, visited the Causeway a few days ago, has received notice that a writ has been issued against him for trespassing upon the property of the syndicate.

PROF. MELDOLA, writing with reference to our note on wasps and flies (p. 549), says:—"I am glad you have again called attention to the useful part played by wasps in keeping flies in check. Many years ago, in an inn parlour on the Essex coast, I made a similar observation with Mr. W. Cole, who was with me at the time. We found hundreds of wings scattered about the window-ledge inside the room, and we were at first at a loss to explain the depredation. While watching, the mystery was solved. The upper part of the window had been left open a few inches, and a wasp came through, caught a fly on the glass pane, instantly clipped off its wings, and flew out of the open upper part of the window with the body. Other wasps followed and repeated the process. For about an hour we observed the continuous arrival of wasps, every one of which secured a fly before departing."

THE weather over the British Islands last week was unusually stormy; the reports issued by the Meteorological Office show that the atmospheric disturbances followed each other at short intervals, and were accompanied with heavy falls of rain in nearly all places. One of the most serious barometric depressions approached our islands from the south-westward on the 7th inst., and the disturbance moved during this and the following day along our extreme western coasts, causing heavy south-westerly gales and terrific seas in the west and north; over an inch of rain fell in twenty-four hours at several places, the amount measured at Holyhead, on the 8th, being 1·8 inches. During this severe gale the Daunt's Rock Lightship, near Cork, disappeared, with her crew of ten men. Notwithstanding the recent heavy rainfall, the reports show that there is still a deficiency of five inches from the average in the south-west of England since the beginning of the year, while the north of Scotland has had over six inches in excess of the normal amount.

LIVERPOOL lacks neither men nor societies devoted to the advancement of natural knowledge; what is apparently needed is the amalgamation of these societies for mutual assistance and support. Dr. H. O. Forbes, in an inaugural address delivered before the Biological Society of Liverpool on Friday last, urged the amalgamation of all Liverpudlian societies interested in biological science. He suggested that such a conjoint society, meeting in some central place and to be called, perhaps, the Biological Institute of Liverpool, or the Liverpool Institute of Natural Science, or if all the scientific societies could be induced to unite, the Royal Society of Liverpool, as was the suggestion, some ten years ago, of Prof. Herdman, might be instituted on the model of the New Zealand Institute. Such a combined society in Liverpool would command wider recognition, and contribute more to the advancement of science, than is at present possible with disjointed forces. Dr. Forbes also expressed the hope that two other scientific institutions of the highest educational value, urgently required in a city like Liverpool—a zoological garden and a resuscitated botanical garden under a trained botanist, both conducted in a thoroughly scientific manner—might be accomplished facts before the end of this century.

BLOWN-OUT shots are responsible for a large proportion of the explosions in coal mines. By a blown-out shot is meant a blast which has failed to effect a rupture of the coal owing to the hole for it having been drilled in a wrong position, or owing to the coal not having been properly prepared by holeing or under-cutting. The gaseous products produced by the combustion of the powder are driven violently into the roadways, mixed with the gas distilled from the coal; and this, with the clouds of dust raised at the same time, provides all the conditions for a disastrous explosion. The Commission appointed to inquire into the cause of the explosion at the Brunner Coal Mine, New Zealand, in March last, have, after full consideration of the evidence, concluded that the primary cause was a blown-out shot fired, contrary to the rules of the mine, in a part of the mine where no work should have been in progress. The coal-gas evolved from the surrounding coal is held to have been ignited as the result of the shot, and the flame then spread throughout the dry portions of the mine. The disaster was accentuated by the explosion of the coal dust raised by the concussion along the main road and working-places, which explosion appears, in some cases, to have been locally intensified by small quantities of fire-damp. No direct evidence was obtained by the Commissioners that the explosion was commenced by an accumulation of fire-damp, or that its extreme violence was due to the combustion of fire-damp mixed with coal-dust.

PROF. A. RÒITI (*Rend. Acc. Lincei*) continues his observations on the cryptochroïsm or phenomenon corresponding to colour in Röntgen rays. In one of his experiments it was found that two plates of brass were equivalent in transparency to eight of aluminium, or sixteen sheets of tinfoil, but the same proportionality did not hold good in the case of certain other combinations of the three metals; thus proving that rays which have traversed a metal plate, differ from those directly emanating from the Crookes tube in their power of penetrating other plates of the same or different metal.

WHETHER high altitudes are productive of anæmia, or lead to an augmentation in the number of red blood-corpuscles, has long been a subject of controversy, the former view having been propounded by Jourdanet in 1863, and the latter by Viault in 1890. A series of observations bearing on this point are described by Dr. Kuthy in the *Atti dei Lincei*. Some of these observations were made on rabbits maintained in an artificially rarefied atmosphere, others on human subjects at high altitudes. In each case an apparent increase, both in the number of red corpuscles and in the percentage of hæmoglobin, was observed; but the author is inclined to regard this effect as due to a modification in the circulation of the blood, by which these constituents are brought to the surface of the body, rather than to a change in its actual constitution.

AN American correspondent writes, under date October 2:—"The albatross flying machine of Mr. William Paul came to grief last Saturday. After waiting nearly a month for a favourable wind, a start was made from the chute after two hours of labour in placing the machine in position; but the first start did not get the machine off the ways. It was replaced a second time and started, but a sudden sideways gust of wind struck and tilted it, turning it about and back on its course. It dropped rapidly from a height of about sixty-five feet, striking a clump of trees, and thence falling to the ground. Mr. Paul was stunned, but not seriously injured. He will build a lighter machine of well-seasoned bamboo during the winter."

THE most extensive and destructive West India cyclone on record swept across America on Tuesday and Wednesday, September 29 and 30, involving tremendous loss of life and property. The cyclone began on Sunday, south of Cuba. On Tuesday it struck the south-west coast of Florida, sweeping away almost the whole of the city of Cedar Keys, and passing through the State with great devastation. In the city of Jacksonville not a single building in the best residential quarter escaped serious injury. The storm inflicted great damage on the cities of Savannah and Brunswick on the coast of Georgia, with loss of life in both cities; and one hundred lives were lost on the sea islands along the same coast. Continuing northward, it spread a wide path of ruin through the country, including conspicuous destruction in Washington, and still more in Alexandria opposite to it, and in Baltimore, and through Eastern Pennsylvania. On Wednesday the storm raged in Michigan and extended to Milwaukee and Chicago, at which points great injury was done to shipping at wharves and outside, very many vessels having been sunk at the wharves in Chicago. The path of this storm was further west than that of the similar one in 1893, which devastated the sea islands and other localities, and the loss of life in this case was due more largely to the fall of débris than to the water.

THE suggestion that the mineral composition of a sedimentary deposit may, if the source of its materials can be traced, afford evidence of the climate that existed during its formation, is not a new one. It has, for example, been put forward by Indian geologists in dealing with the Permo-Carboniferous glacial deposits in the southern hemisphere. It appears to have been independently arrived at by Mr. G. P. Merrill, as a result of his investigations on the decay of certain crystalline rocks. Using the term *degeneration* to cover *all* the processes by which a massive rock is brought to the state at which its materials are easily transported, he distinguishes the physical and mechanical processes as *disintegration* from the chemical one of *decomposition*. The former may be said generally to predominate in its results over the latter in cold and in dry climates; though many qualifying considerations must be taken into account. Apart from this generally interesting conclusion, the two papers by Mr. Merrill, on the granitic rocks of the district of Columbia, and on a diabase dyke at Medford, Massachusetts (*Bull. Geol. Soc. America*, vol. vi. p. 321; and vol. vii. p. 349), contain most detailed mechanical and chemical analyses of these rocks in various stages of degeneration, with full discussions on the evidence so obtained. It is to be hoped that many similar analyses may be made in other parts of the world, in cases where the conditions of occurrence are equally favourable.

IN an elaborate communication by Prof. Bernhard Fischer, on the pollution of the water in the harbour of Kiel, some interesting determinations are incidentally given of the bacterial contents of several samples of sea-water made by Dr. Bassenge, on a voyage from Kiel to the Azores. Prof. Fischer himself made some time previously various examinations of sea-water selected from different places, and together the results furnish an interesting addition to our knowledge of marine-bacteriology. The average microbial contents of sea-water at some distance from land appear to be mostly under 250 per cubic centimetre, but in the English Channel, Skaggerack, Kattegat, and other more or less confined sea areas, the number reaches an average of 500 per c.c., and rarely rises above 1000 c.c. Near the coast and in sea harbours the number may be much higher; thus in Plymouth harbour as many as 13,320 per c.c. were found, although in the vicinity of Dartmouth only 800 bacteria per c.c. were obtained. Dr. Fischer attempts on these results to set up a numerical bacterial standard of purity for sea-water, and he has fixed upon a limit of 500 per c.c. as affording a safe index as to the unpolluted character of sea-water, whilst a higher figure should, he considers, be taken as a sure sign of contamination. With all due deference to Dr. Fischer's arbitrary standard, we think that there is too great a tendency at the present time to try and create bacterial numerical standards. Bacteriology does not admit of being dealt with on such a hard and fast basis, and whilst in some cases a large number of bacteria may mean nothing at all, and be without any further significance, on another occasion a far smaller number may be an index of danger. We have recently had an attempt to start a milk bacterial-standard; now we are to have a fixed sea-water microbial-measure, it only remains for our aërial surroundings to be bacterially standardised!

ANOTHER instance of the valuable work done at the Royal Gardens, Kew, in the organisation of botanical nomenclature, is afforded by the descriptive list of new garden plants of the year 1895, just issued as a *Bulletin of Miscellaneous Information*. To prepare and publish an annual list of the garden plants described in botanical and horticultural publications, both English and foreign, is no easy task; yet such a list, comprising all the new introductions recorded during last year, is now published. It hardly needs pointing out that lists of this character are indispensable to a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew. In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, with botanical names, and described for the first time in 1895, are included in the Kew list.

UNDER certain conditions, charcoal is liable to spontaneous combustion. The assertion has been made that charcoal used in building refrigerating chambers on shore and on board vessels has ignited spontaneously; but the evidence on this point appears to be quite insufficient to support this serious charge. The results of an inquiry into the alleged liability of wood charcoal to spontaneous combustion, by Mr. W. D. A. Bost, have been published in a slender volume by Mr. Alexander Gardner. The fact of the matter seems to be that though freshly-made charcoal—that is, charcoal which has not absorbed its moisture—and oxygen is liable to so-called spontaneous combustion; it is never liable to re-ignite after having been exposed to the air for a few days. In any case, it seems that if after a few days no fire shows itself, the charcoal may be regarded as safe. The scare arising from the supposed danger from the ignition of charcoal used in insulating refrigerating chambers may, therefore, be regarded as groundless.

THERE appears to be no grounds for the statement made by Herr Schmeltz in the *Internationales Archiv für Ethnographie*, and referred to in NATURE, July 9, p. 237, that the Government of New Zealand had developed a sense of prudery in regard to the ithyphallic idols and figures in the Auckland Museum. Mr. T. F. Cheeseman, the Curator of the Museum, informs us that no idols whatever have been mutilated since the Museum has been under his charge, and the ethnographical collections have been almost wholly formed since his appointment. There are two or three large mutilated figures in the Museum, but that was done long before they came into the Museum, and probably dates from the period of missionary activity in New Zealand. Mr. Cheeseman very much doubts the accuracy of Herr Schmeltz's statement respecting the restriction of the importation of the phallic chalk figures from New Zealand. For many years such specimens have been on exhibition at the Auckland Museum, without objections being raised by the Government or any one else.

AT the last meeting of the American Institute of Mining Engineers, held at Denver in September, one of the most interesting papers read was on the "Micro-structure of Steel and the Current Theories of Hardening," by A. Sauveur. Mr. Sauveur recognises only four constituents of steel, viz. ferrite or pure iron; cementite or Fe_3C, isolated by Abel in 1855; pearlyte, an extremely intimate mixture of ferrite and cementite, arranged either in lamellæ or granules; and martensite, the composition of which cannot be determined by the microscope. Martensite exists only in hardened steel at ordinary temperatures, and is converted into pearlyte in the process of annealing. It appears to correspond with Arnold's hypothetical subcarbide, $Fe_{24}C$; but inasmuch as it is of variable composition, containing as little as 0·12 per cent. of carbon in very mild steel after quenching, and as much as 0·90 per cent. in hard steel, it follows that no single formula can express its composition. Mr. Sauveur is also dissatisfied with the allotropic theory of the hardening of steel, mainly on two grounds. First, he observes that the allotropists say that the iron passes from the hard β to the soft α state on cooling through the critical point Ar_2, and consequently iron quenched between Ar_2 and Ar_1 should be soft, while Mr. Howe has shown that it is hard. Secondly, according to the allotropic theory, slowly cooled non-magnetic manganese steel should be harder than quenched carbon steel; while, on the contrary, it is far less hard than steel containing much carbon. Mr. Sauveur suggests that the absorption or evolution of heat at the critical points is due to the structural changes which occur at these points. This seems to differ hardly at all from the views of the allotropists, for it is next to impossible to exclude structural changes, accompanied by thermal disturbances, from the list of allotropic changes. Lastly, Mr. Sauveur attributes the hardening of steel to the existence of a network of minute plates of Fe_3C disseminated through the mass; a view which will assuredly not put an end to the violent controversy which rages round this point, if indeed it meets with any support at all.

THE reference, in our last issue, to the first number of *Il Naturalista Siciliano* should have been to the first number of *a new series* of that periodical, which has been published continuously since 1882.

MANY naturalists may be glad to know that Mr. R. H. Porter, Cavendish Square, London, has just published a catalogue containing nearly four thousand titles of new and second-hand books on natural history offered for sale by him.

WE have received the *Proceedings* of the Natural History Society "Isis" of Dresden, for 1895, which is almost entirely occupied by a paper by the editor, Dr. O. Drude, on the distribution of eastern plants in the Flora of the Saxon Elbe-valley.

THE Division of Vegetable Physiology and Pathology of the U.S. Department of Agriculture has issued an important paper by Mr. W. T. Swingle (*Bulletin* No. 9), on the use of "Bordeaux mixture," a mixture of copper sulphate and lime, as a fungicide for vegetable crops.

MR. J. W. MARRIOTT has taken all the questions contained in the papers set by the Department of Science and Art in Practical, Plane, and Solid Geometry since 1884, and has arranged them on a graduated scheme, so that they can be used as exercises upon the various sections of the departmental syllabus. This graduated arrangement under different headings, and the lithographed diagrams accompanying the questions, should be of assistance to teachers of the subject. The questions are published in two sets—Elementary and Advanced—by Mr. E. Coward, Blackburn.

THE Meteorological Institute of Copenhagen has just distributed an important summary of the meteorological observations made in that city during the years 1751–1893. This period embraces no less than 143 years; but from various causes, the results of several of the intermediate years are missing, and the observations have naturally been taken at various hours and localities. Since 1874 they have been made under the immediate superintendence of the Institute, and consequently these possess a much higher value than the earlier series. The annual temperature varied between 49·3° and 41·2°. The mean annual rainfall was 22·1 inches. The summer is the wettest season; the winter and spring being much dryer than the other seasons. The author (Mr. V. Willaume) discusses the data from various points of view, *e.g.* their possible connection with sun-spots, and the moon's influence.

THE *Proceedings* of the Rochester (New York) Academy of Science, Brochure i. of vol. iii. of which has lately come to hand, is a pleasing production, and is a proof that no pains or expense are spared to make it thoroughly attractive in appearance. The section before us is occupied by a paper by Florence Beckwith and Mary E. Macauley, assisted by Joseph B. Fuller, on "Plants of Munroe County, New York, and adjacent territory." The list aims at the inclusion of the names of plants growing without cultivation in Munroe and adjoining counties, and care has been exercised in the determination of specimens, the authors having excluded all those concerning which there have been reasonable doubts. A general comparison is given of the Munroe flora, with lists of plants covering territory east and west of the area under discussion, *i.e.* the territory of Buffalo and the area of Cayuga, and the result as given by them is as follows: The total number of species enumerated in the Buffalo list is 1289, that in the Cayuga flora is 1278, and that in the Munroe list is 1309. The paper is illustrated by a map of the region discussed, and by a diagram showing the stratigraphy of the same.

THE additions to the Zoological Society's Gardens during the past week include two Lions (*Felis leo*, ♂ ♀) from North-east Africa, presented by Mr. C. A. Osborne; two Globose Curassows (*Crax globicera*, ♂ ♀) from Central America, presented by Mrs. Sedgwick; a Whinchat (*Pratincola rubetra*), a Redstart (*Ruticilla phœnicurus*), a Blackcap (*Sylvia atricapilla*), a Swallow (*Hirundo rustica*), British, presented by Mr. John Young; a Cape Viper (*Causus rhombeatus*) from South Africa, a Rufescent Snake (*Leptodira rufescens*) from East Central Africa, presented by Mr. F. V. Kirby; a Smooth Snake (*Coronella lævis*), European, presented by Mr. A. E. T. Jourdain; two Hairy Armadillos (*Dasypus villosus*) from La Plata, a Peba Armadillo (*Tatusia peba*) from South America, deposited; two Maguari Storks (*Dissura maguari*) from Chili, three Laughing Gulls (*Larus atricella*) from North America, purchased; two Collared Fruit Bats (*Cynonycteris collaris*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL SOCIETY OF WALES.—We have received the *Journal* of this Society for September, and find it contains some useful information for amateurs. Besides current notes and some short contributions from various members, a brief description is given of the conditions under which Mars is now visible. This is accompanied by some illustrations, among which is an excellent map of Mars, by Schiaparelli. We notice in the table given at the end, describing "The Heavens" for October, that the period of the variable star η Aquila is given as two days nine hours; this is evidently incorrect, being the time from a minimum to a maximum. A variable star period is generally reckoned either from minimum to minimum, or from maximum to maximum, and its length in the case of this star is, roughly, seven days four hours.

THE ELEMENTS OF COMET 1885 III.—Both Messrs. W. W. Campbell and Gallen Müller have calculated the elements of the orbit of this comet, discovered by Mr. W. R. Brooks at Phelps, New York, on August 31, 1885. These computations were made independently of one another. Mr. Campbell's work led us to believe the orbit of this comet to be an ellipse, with a period of revolution of 495·7 years; while Mr. Müller gave us two orbits, one elliptical with a period of 403·2 years, the other a parabolic orbit. It seems that the observations used as a basis for the calculation, both include one made at Dun Echt by Dr. Copeland on October 5. This observation forms the last placed position in both calculations. On this the value of the eccentricity obtained entirely depends. Owing to this uncertainty, the observation has been replaced by three observations by M. Bigourdan, which had not been published when the calculations were commenced. These latter observations get rid of this difficulty, and give us the means of ascertaining whether the eccentricity is real or not. The computation has been undertaken by Mademoiselle Klumpke, at the request of Prof. Schulhof, and is published in the *Bulletin Astronomique* for September. The investigation shows that the new elements deduced give a period of revolution of 247·5 years. This period is, as Mademoiselle Klumpke says, with certainty relatively short. It takes a fifth place among those comets, the time of revolution of which is greater than a hundred years. Mademoiselle Klumpke further suggests that the theory of the capture of comets would attribute the elliptical character of this orbit to the action of Jupiter, the minimum distance between the two orbits being 0·22. The following are the elements finally deduced:—

Final Elements.

$$\begin{array}{rcl} & & \quad ^\circ \quad\; ' \quad\;\; '' \\ \mathrm{T} & = & 247\ 36\ 57{\cdot}65 \\ \Omega & = & 204\ 45\ 24{\cdot}52 \\ i & = & \;\;59\ \;\;6\ 35{\cdot}43 \\ \log q & = & 9{\cdot}8745682 \\ e & = & 0{\cdot}9822627. \end{array}$$

THE LEANDER MCCORMICK OBSERVATORY.—The *Alumni Bulletin* of the University of Virginia contains an account of the principal work in hand at the Leander McCormick Observatory. At present the chief work is the observation of the relative positions of the satellites of Saturn, and the discussion of the measures for the purpose of improving our knowledge of their motions.

The orbits of Titan and Japetus are fairly well known, so special attention is given to the remaining satellites. All of these are faint, and a powerful telescope is needed to observe them accurately. The most easily observed are Rhea, Dione, and Tethys, and a fine series of relative positions of these has already been secured, from which it is hoped to obtain greatly improved orbits of those bodies. Mimas, the satellite nearest to the ring, is very faint, so that it can be observed only under favourable atmospheric conditions, and only when near the points in its orbit where its apparent distance from Saturn is greatest. As a result the inequalities in its motion are not at all well known, and further observation is desirable. The same is true to a less extent of Enceladus, the next satellite beyond Mimas. The orbits of both these satellites are useful in determining the mass of Saturn's ring. Hyperion is also extremely faint. The motion of this satellite is greatly affected by the attraction of Titan, and the determination of its orbit involves difficulties that render it one of the most interesting problems of the solar system.

The observations of these satellites are being published from time to time in the *Astronomical Journal*. Their discussion has occupied the attention of the Director during a large portion of the past year. The investigation is of great importance, and the results obtained will lead to the gradual solution of the mechanical problems involved in the motions of the Saturnian system.

THE SOLAR ROTATION.—The great amount of material that we now possess with regard to solar phenomena has led many to form theories of the rotation of the sun, which differ among themselves both in the method of treatment employed and in their value. Of those more recent, that which we owe to E. J Welczynski, is published in the current number of the *Astrophysical Journal* (August 1896). The author commences by forming the hydrodynamic equations of Lagrange, by assuming the coordinates of any point of a fluid, and the position of this point at a certain time ($t = 0$). A fourth equation is obtained further by differentiating with regard to the time, the product of the density of the fluid at the initial position, and a determinant containing (in rows) the differential of the coordinates of the first point to those of the second. He then proceeds to rotate the whole mass round the axis of z, where ω is the angular velocity of rotation depending on the coordinates of the point $t = 0$. The equations then become simplified, and it is found that the square of the angular velocity is a function of the distance of the moving point from the axis of rotation, or, in other words, ω depends only on the value of r. The equations of Lagrange thus become further simplified, and conditions are inserted for the case in which the fluid is a gas, and the absolute temperature not constant throughout. The equation arrived at finally is

$$4\pi\rho + c\Delta\mathrm{T} + c\Delta\log\rho = 2\omega^2 + r\frac{d\omega^2}{dr}.$$

Welczynski then identifies this rotating mass with the sun, which he assumes spherical. Since ω depends on r, he imagines the sun's axis the common axis of a series of cylinders, so that the velocities of points on the surfaces of each of these would be constant for each cylinder, the surfaces rotating as if they were solid. "But from one cylinder to another ω changes according to a certain law, $\omega = f(r)$, which, according to (10) [equation given above] depends upon the distribution of temperature and pressure in the sun's interior. Since we know nothing of these qualities it is impossible to deduce theoretically a formula for the solar rotation." He remarks further that it is important to note that "if $\omega = f(r)$ is known from observation, equation (10) gives a condition which the temperature and density of the solar interior must satisfy. If it were possible to find a second condition of this kind, it would be possible to find the laws according to which these quantities vary from point to point." He suggests that such an equation would follow if the periodicity of the sun-spots be a hydrodynamic phenomenon. The paper concludes with a reference to the position of the faculæ with reference to these spots. The faculæ being further from the centre of the sun than the spots, the former, even on the same heliographic latitude, would move faster, as the velocity of rotation increases the greater the distance from the sun. In fact a means is afforded here of determining the difference in the altitude of spots and faculæ, this difference being stated to be "considerable, almost 1/60 of the solar radius."